Shaw® Shaw Environmental, Inc.

Shaw Environmental, Inc
11 Northeastern Boulevard
Salem, NH 03079-1953
603.870.4500
FAX: 603.870.4501

March 21, 2007
Project 124246

John, A. Carrigan, Chief
Solid Waste Management Section
Massachusetts Department of Environmental Protection, NERO
205B Lowell Street
Wilmington, MA 01887

Re: Crow Lane Landfill, Newburyport, Massachusetts
Background to design concerns for the Perimeter Berm

Dear Mr. Carrigan:

Shaw Environmental Inc. prepared a draft issues list concerning the MSE Berm to assist your preparation of the March 7, 2007 Notice of Deficiency (NOD) to William Thibeault of New Venture Associates, LLC. This letter provides additional background documentation to technical issues where such they may not have been self evident in the NOD. The format below follows the list contained in the NOD. The NOD issue is in italics.

1. *Berm Foundation:*

   a. *Additional information must be supplied demonstrating the existing foundation soil properties are suitable to support the berm and achieve the parameters used in design of the berm and computation of its stability. This information should be in the form of test pit or boring logs, and laboratory test data from a sufficient number of samples identified on the logs along the entire length of the berm.*

      Geocomp assumed minimum acceptable factors of safety (FS) of 1.3 and 1.5 for global and bearing capacity failures of the berm respectively. Geocomp has also assumed an effective friction angle of 35 degrees for native soil. Based on the lack of material data for the underlying soils, a FS of 1.3 for berm bearing capacity failures should not be used without a high level of confidence in the material data.

b. *Additional information must be supplied demonstrating all unsuitable materials have been removed from under the existing berm. This information may be in the form of detailed construction notes taken during construction, photographic documentation, or, in the absence of such conclusive material, new information obtained by boring though the berm and subsurface soils along the entire length of the berm.*

   Given the very critical location of the soil stratum, additional data is needed that demonstrates the soils meet the strength requirement in 1. a. above, and that all other unsuitable soils were removed prior to berm construction along the alignment of the berm.

2. *Berm Construction:*

   a. *Additional information must be supplied demonstrating the existing berm was constructed with materials of a minimum strength used in the design stability analysis. Materials from various sources have been used for berm construction. An insufficient number of samples have been tested to assure that all berm materials meet the minimum shear strength identified by the stability calculations. If this documentation is not currently available, then it may be obtained from borings through the berm with continuous sampling and laboratory testing of representative samples.*

      Self explanatory.

   b. *Additional information must be supplied demonstrating the existing berm was constructed as a controlled fill. This would include construction field notes, photos showing lift thickness (typically 9 to 12 inches) and documentation that compaction took place with an adequate number of passes of a vibrator roller compactor, and in-situ moisture density test results demonstrating sufficient material compaction was achieved. Alternatively, adequate berm strength may be demonstrated by borings through the berm with continuous sampling and measurement of blow counts. A geotechnical engineer must interpret the data.*

      There is insufficient documentation demonstrating the existing berm was constructed as a controlled fill to support the strength assumptions Geocomp made during their stability analysis.

   c. *Additional information must be supplied demonstrating the berm surface material achieves a factor of safety (FS) suitable for the design. The stability analysis provided assumed a berm material shear strength of 38 degrees. This provides a factor of safety of 1.17 against surficial sloughing without any environmental forces, such as runoff, working on the material. A factor of safety of less than 1.5 is not suitable when considering these factors. Additional information must be supplied demonstrating how the final surface* *slope will be stabilized. Materials that will ensure the FS suitable for this design must be identified and plans must be provided that demonstrate that the placement of the materials will protect the underlying more erosive material.*

Self explanatory.

d. The 1:1 (H:V) rip-rap sloped berm along the west and north berm must be shown to be stable from surface failure, localize slump failure and global stability failure. Design analysis, details, and specifications must be provided for constructing the proposed stone buttress at the base of the westerly and northerly slopes.

There was no supporting design information indicating that this berm has a suitable long-term FS against failure.

3. Reinforced Earth Wall Design – Additional information must be supplied demonstrating the wall can be constructed on top of the existing berm in a stable manner. This information shall include:

a. A revised construction specification Part 2.04. The specified gradation for the reinforced backfill (geogrid in-fill) is not consistent with materials specifications required for achieving an internal friction angle of 40 degrees.

Self explanatory.

b. Specifications for all materials to be used, including Clean Structural Fill.

Self explanatory.

c. Revisions as necessary to achieve minimum acceptable factors of safety for both global and bearing capacity failures of the berm. A factor of safety lower than 1.5 is not suitable given the lack of material data for the underlying soils and/or the construction of the existing portions of the berm. Such revisions may include revision of the design to increase stability and/or revision of the stability analysis to reduce the level of uncertainty of the analysis/design.

Self explanatory.

d. A revised stability analysis to check for circular failure through the berm subgrade for the worst-case condition, as well as additional stability analysis for the worse case combination of both wall and berm heights.

Geocomp did not include these analyses in their stability analysis.

e. *Additional slope stability analysis must be performed to include the potential slip surface along the Geomembrane located behind and under the Reinforced Earth Wall. This condition is currently in-place and should be represented by surveyed as-built conditions in the most critical locations, if different from the existing cross section locations and the additional analysis requested under item d, above.*

   Geocomp did not use the worst case height or failure surface scenarios when performing their stability analysis. Also, Shaw performed a slope stability analysis for cross-section A-A' using GSTAB7 that showed a FS of 1.35 with a circular failure surface (lower than Geocomp's FS of 1.75 assuming the three-part wedge failure surface), and potentially lower than 1.3 using worst case failure surfaces.

f. *Additional details of the geogrid wall facing and the secondary geogrid reinforcements (of shorter length) used in between the primary geogrids for wrapping around the wall facing.*

   There is insufficient material specification and details demonstrating how the wall will be constructed and maintained. It is unclear whether secondary geogrid reinforcements are required between the primary geogrids, and there are no details showing the wall facing.

g. *Revised design drawings to match the conclusions of the geogrid reinforcing determined by the stability analysis.*

   SITEC shows geogrid lengths of 0.8 times the berm height within the bottom third, and 0.6 times the berm height within the bottom two-thirds of the berm in all three cross-sections. Geocomp's stability analysis shows the following geogrid configurations:

   > Cross-Section A-A' – 1.0 times the berm height within the bottom half and 0.67 times the berm height with the top half of the berm.
   >
   > Cross-Section B-B' – Approximately 0.9 times the berm height over the entire height of the berm.
   > Cross-Section C-C' – Approximately 0.92 times the berm height within the lower fourth and approximately 0.77 times the berm height within the top three-fourths.

h. *Revision of the test designation for tensile strength of geogrid to be ASTM D6637 and the test method for junction strength of the geogrid to be GRI GG-2.*

The test designation for tensile strength of geogrid needs to be changed to ASTM D6637, and the test method for junction strength needs to be changed to GRI GG-2 because the methods listed in SITEC's specification are incorrect. For geogrid tensile strength SITEC lists ASTM D4595, which is used for geotextiles, and is outdated in its use for geogrids. For junction strength SITEC lists GRI GG-1, which is incorrect.

Item 4, the request for a Construction Quality Assurance Plan to document berm construction is necessary to assure the berm will be constructed according to the design requirements and subsequently should not fail during the post closure period or longer.

Should you have any question regarding this information, please do not hesitate to contact us.

Sincerely,

Shaw Environmental, Inc.

Benjamin Siebecker, PE
Senior Engineer

Ed VanDoren, PE, LSP
Project Manager